Effectiveness of interactive 3D viewers on stakeholders' understanding and communication of geology

Jason Thomason[1], Andrew Anderson[1], Don Keefer[1], Zbigniew Malolepszy[2]

[1]Illinois State Geological Survey, USA

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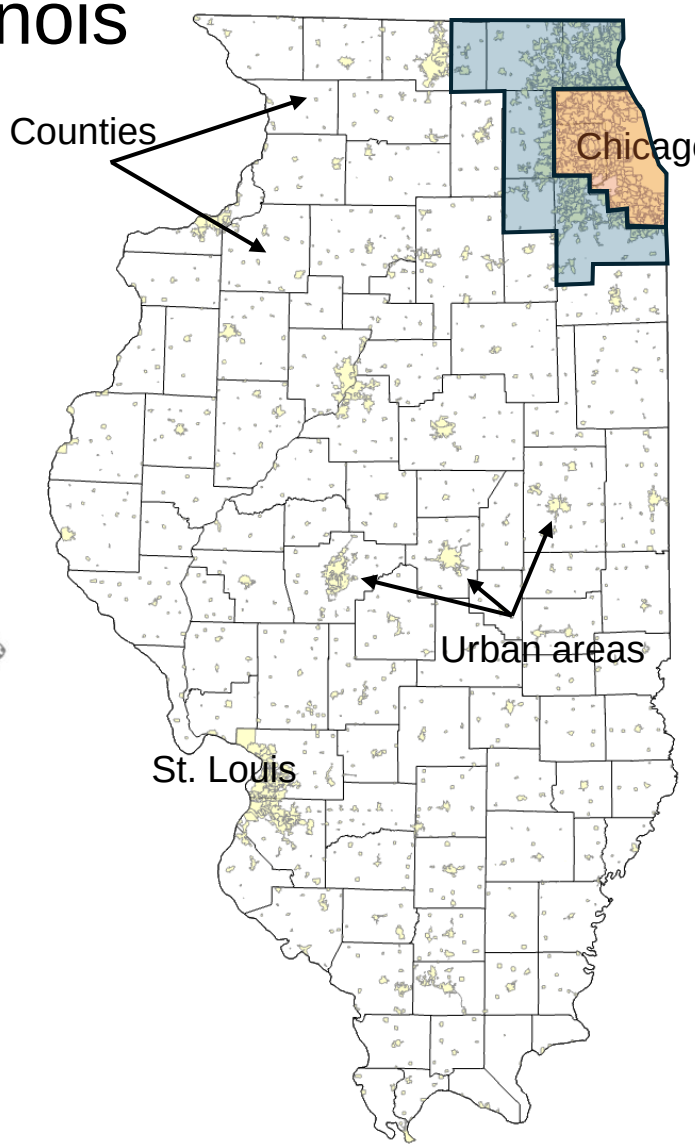
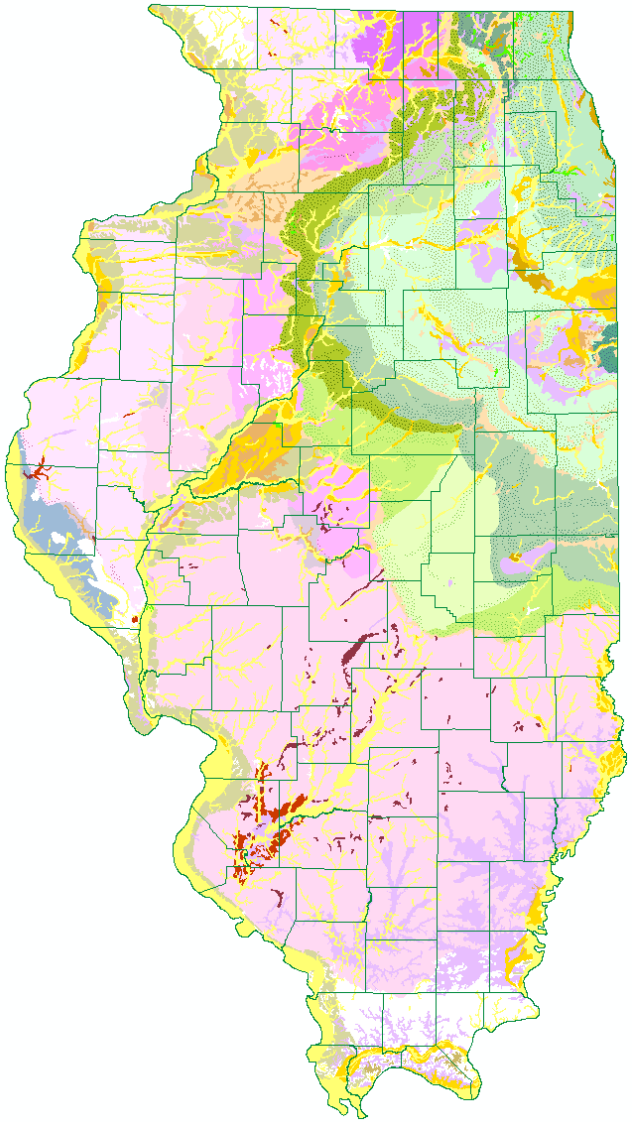
3D Geological Modelling in Illinois

Justifications

- Water resources
- Infrastructure
- Aggregate resources
- Land-use planning



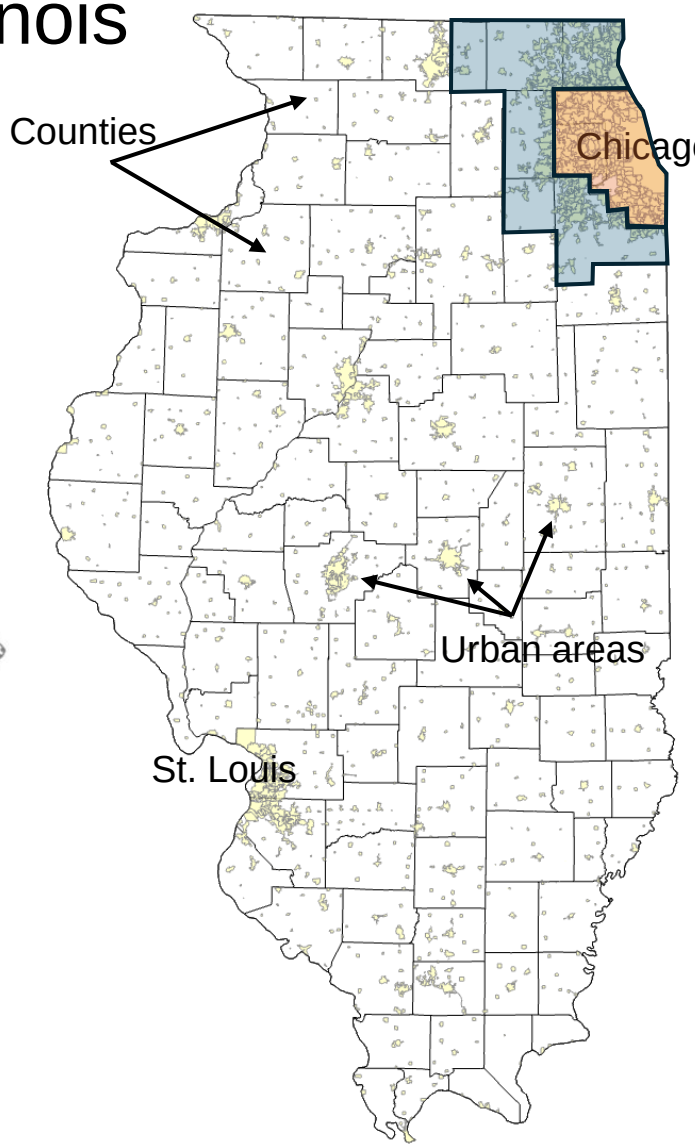
Glaciated terrain



3D Geological Modelling in Illinois

Modelling Software

- EarthVision
- Rockworks
- ArcGIS
- GSI-3D
- **GeoScene3D (I-GIS)**



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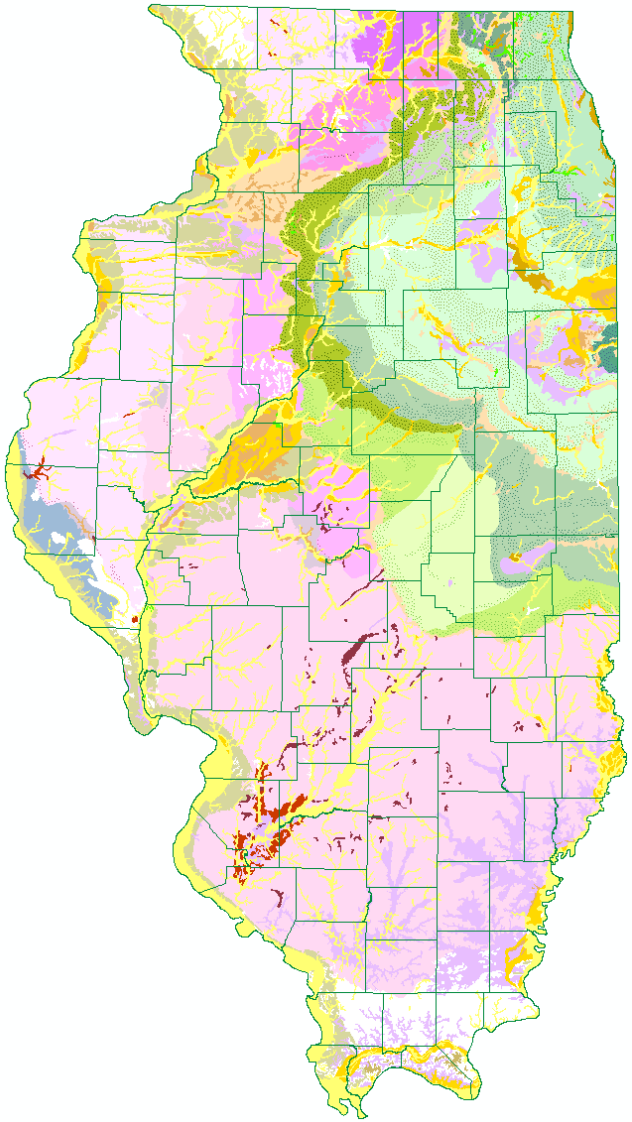
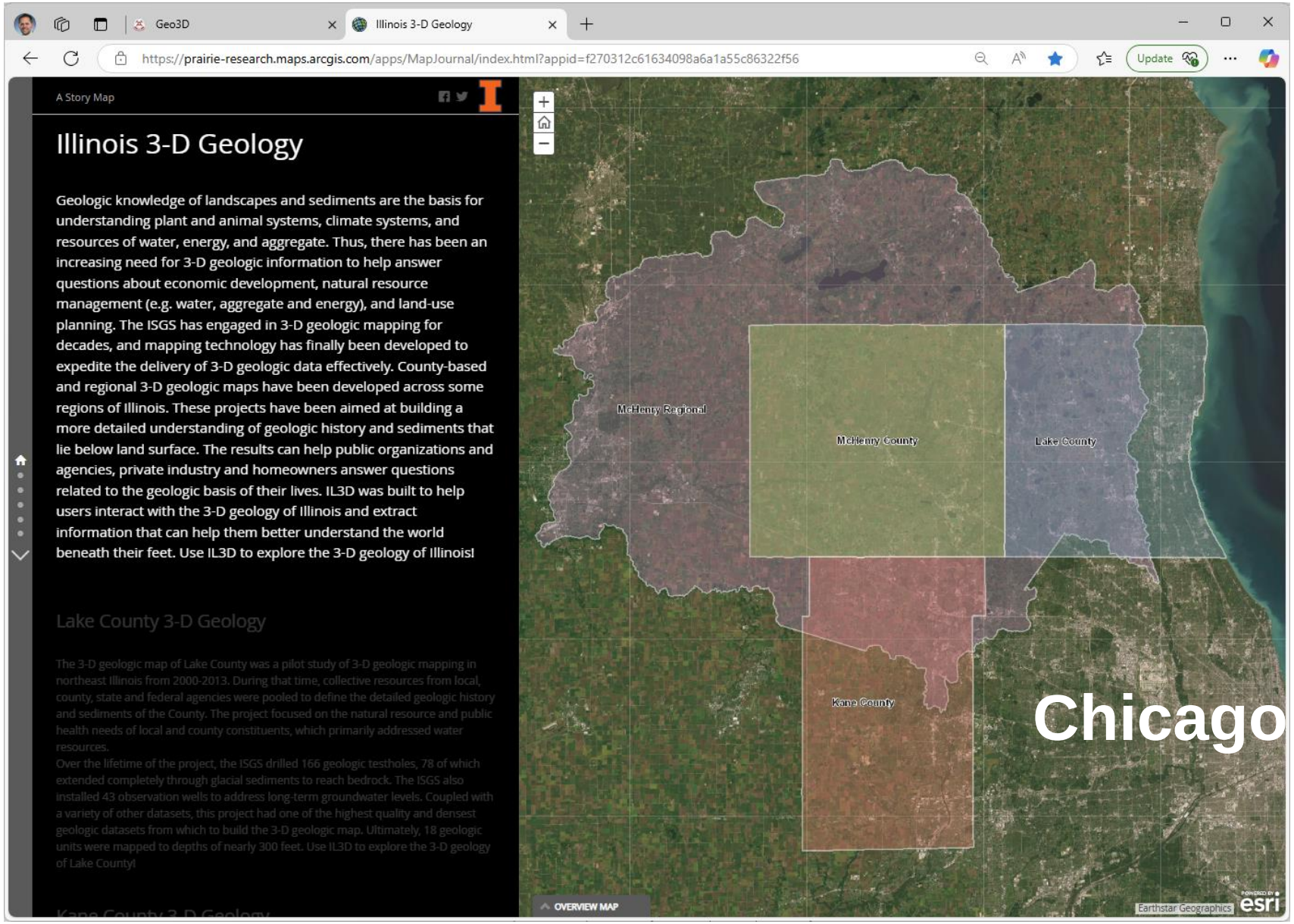


3D Geological Model Delivery

Since 2021

- Storymap interface
- Embedded model viewer
- 4 county models
- 1 regional model

[Illinois 3D Geology]



3D Geological Model Delivery

Since 2021

- Storymap interface
- Embedded model viewer
- 4 county models
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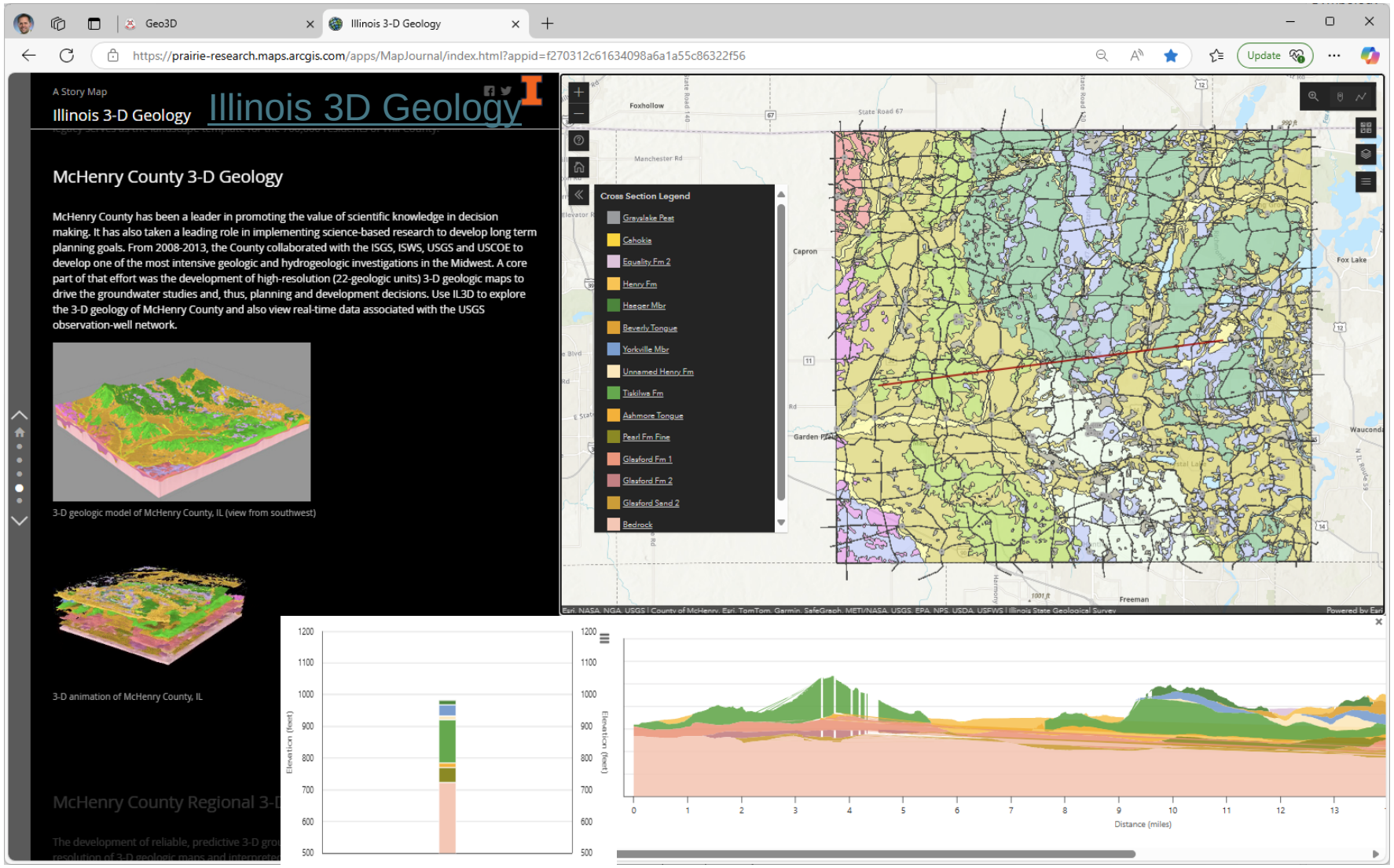
Stakeholders request tools for:

- Ease of communication
- Rapid illustration
- Data queries
- Ordinance support

Model viewer: ArcGIS Maps SDK for JavaScript v. 4.24

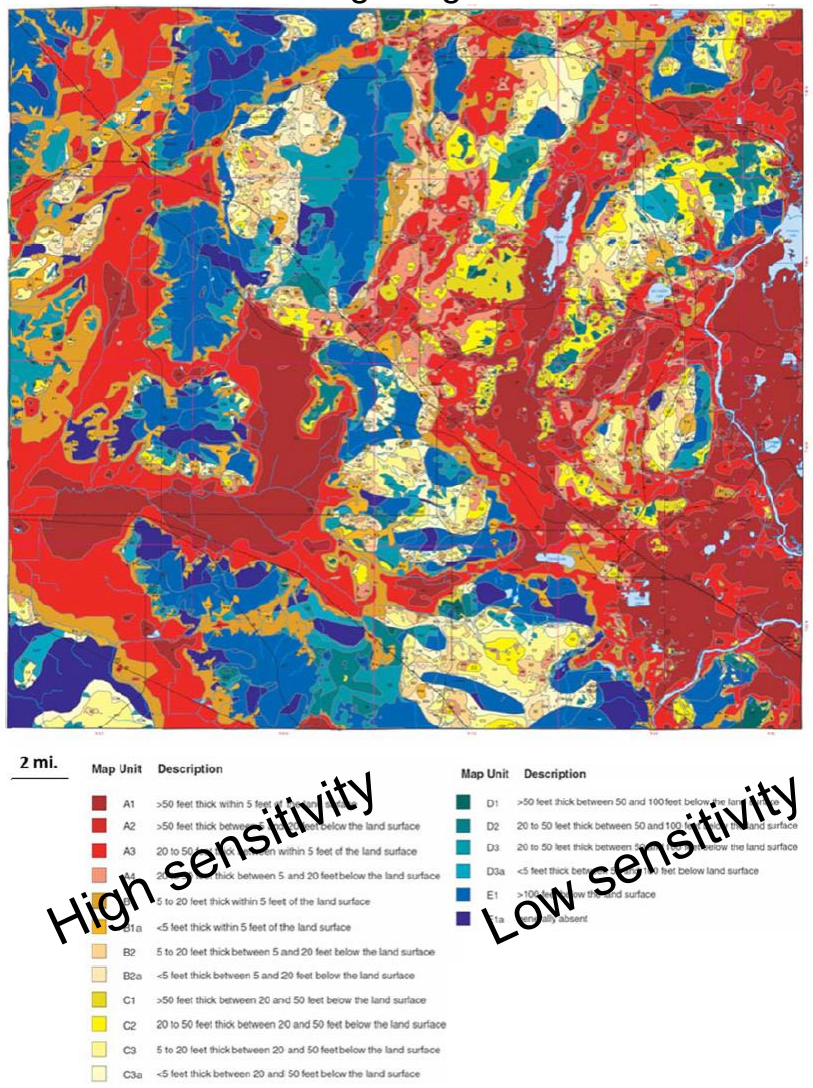
Cross sections using Highcharts

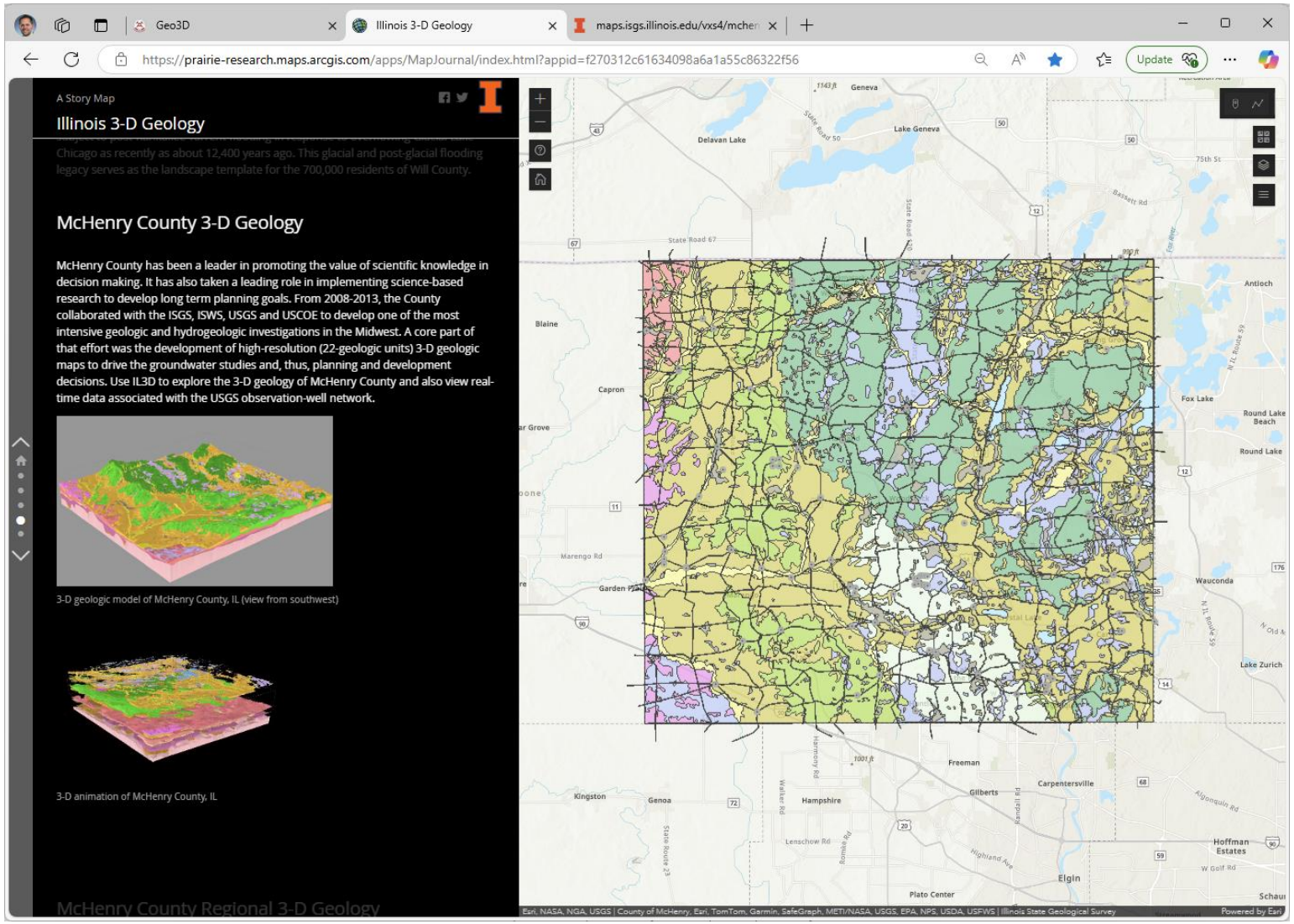


Case Study 1: Water-resource manager

McHenry County, Illinois, USA

Aquifer Sensitivity Map
from 3D geologic model



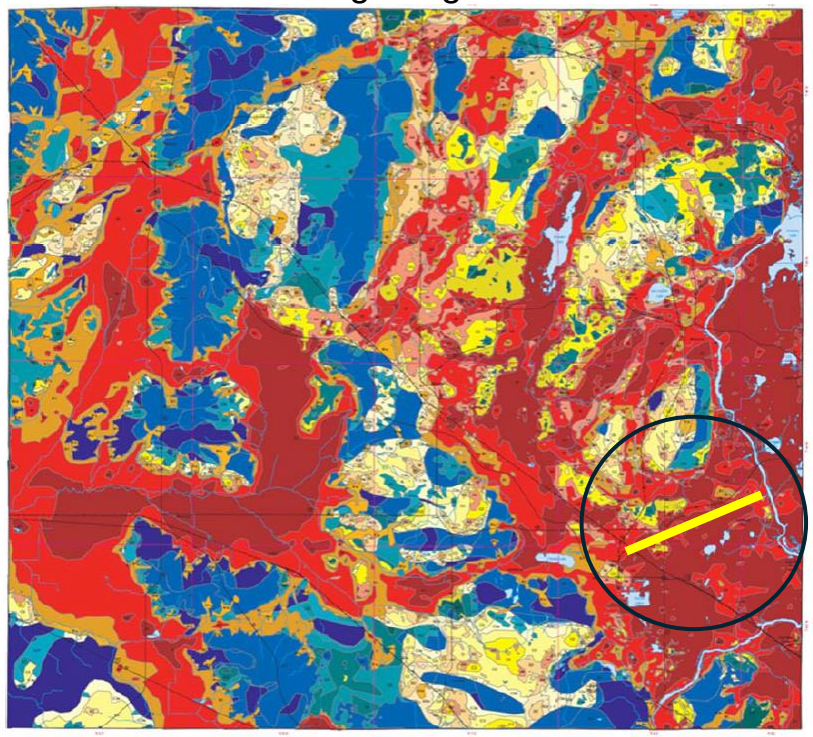


Case Study 1a: Water-resource manager

McHenry County, Illinois, USA

Aquifer Sensitivity Map

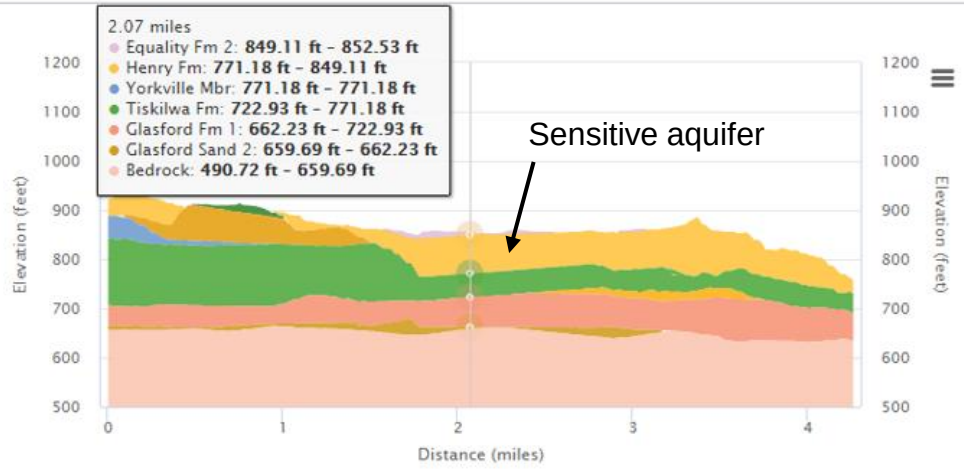
from 3D geologic model



Aquifer Protection Ordinance

Requires 50% permeable surfaces in sensitive areas

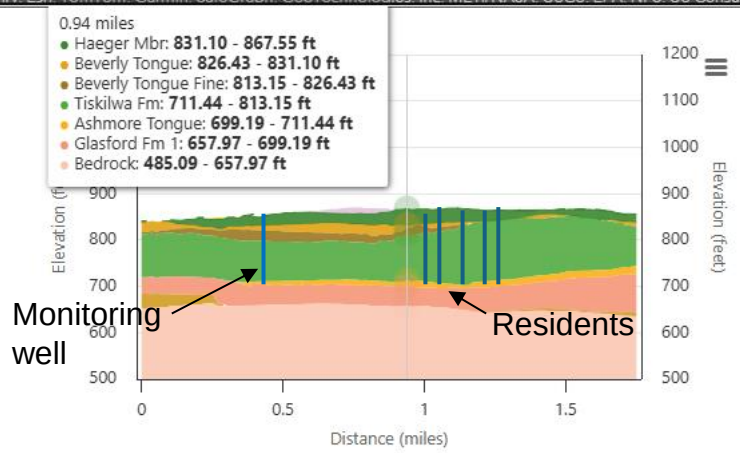
- ***Developer thought to challenge, but 3D viewer supported ordinance***



Case Study 1b: Water-resource manager

McHenry County, Illinois, USA

3D viewer application

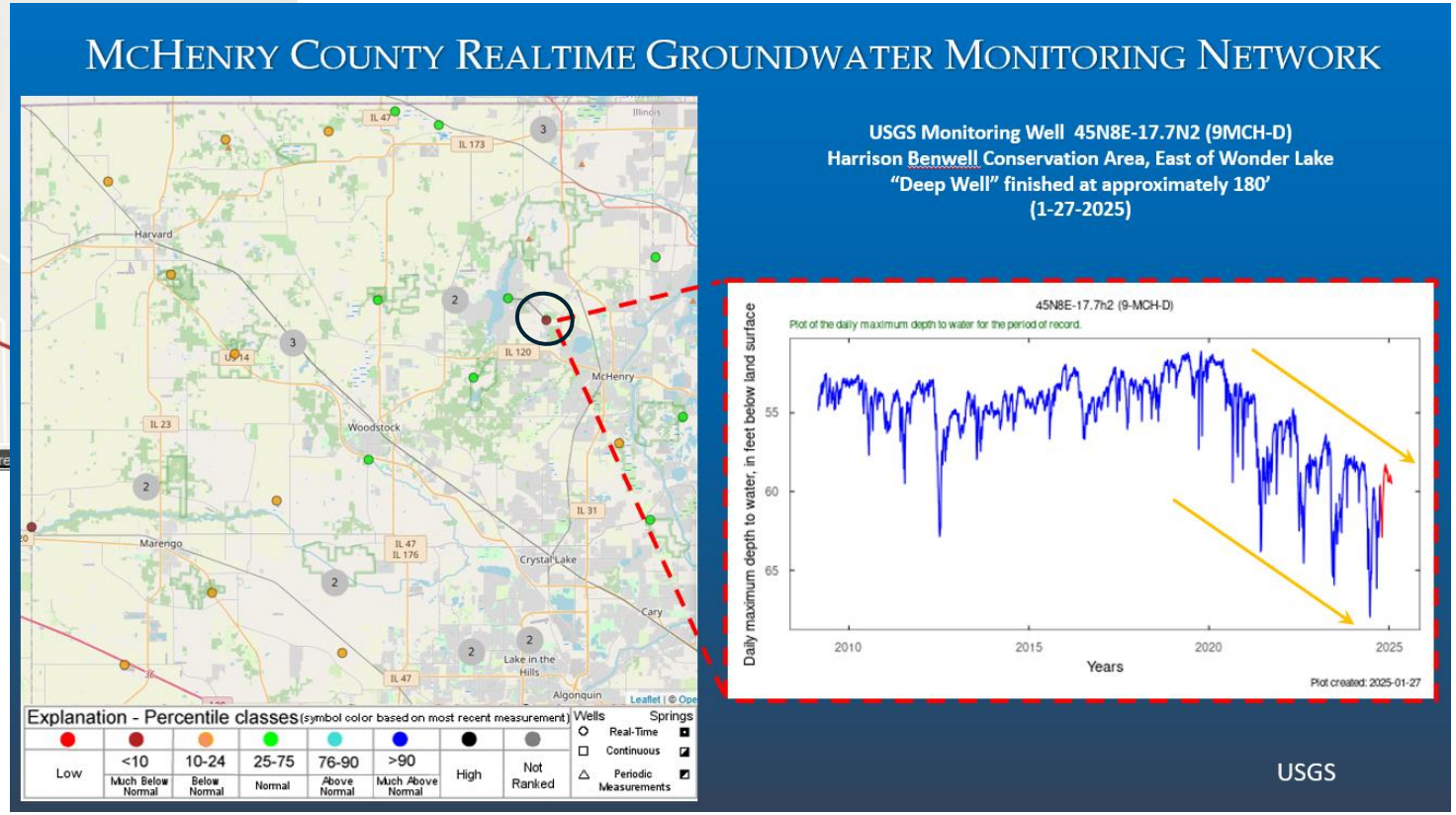


Rapid drawdown of aquifer

Water-level decline of ~2.5m in 5 years

Beginning of 5,000 home development

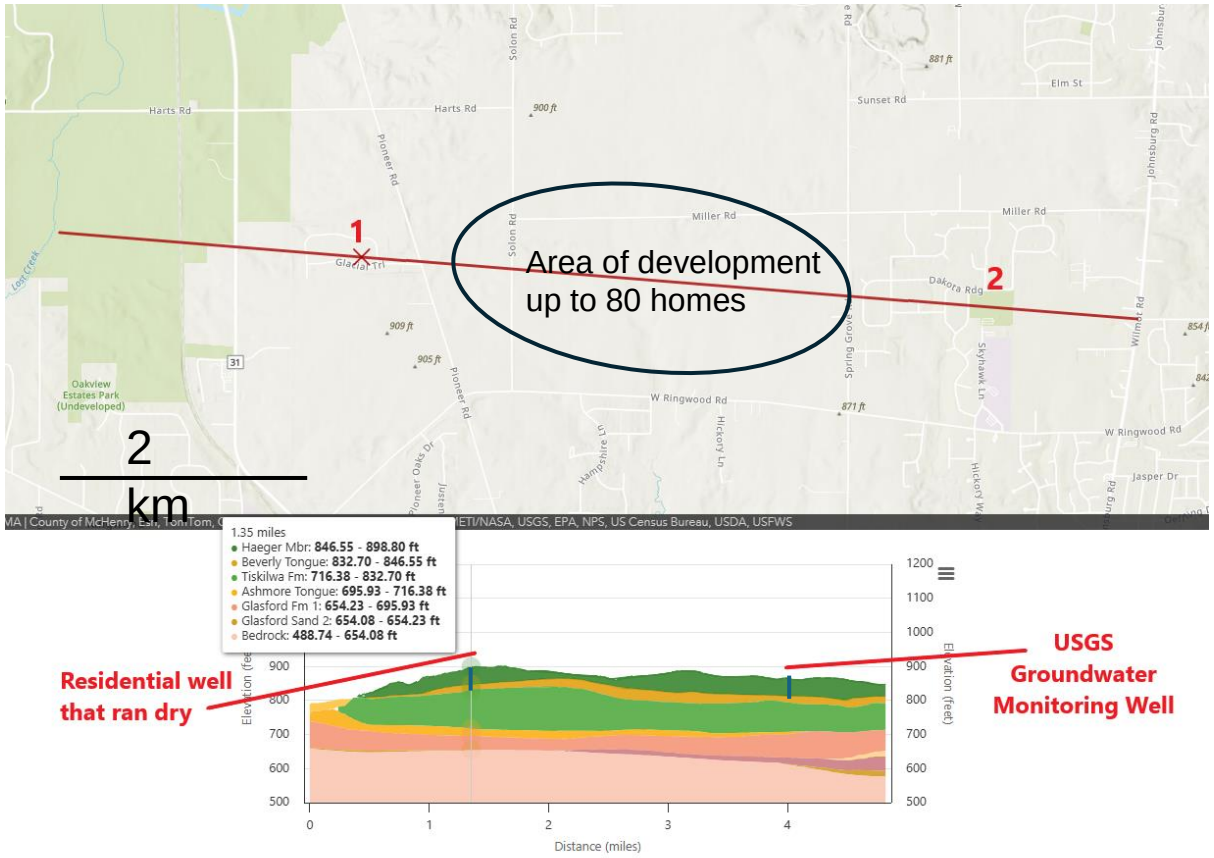
- ***Started discussions between County, City and Developer***



Case Study 1c: Water-resource manager

McHenry County, Illinois, USA

3D viewer application

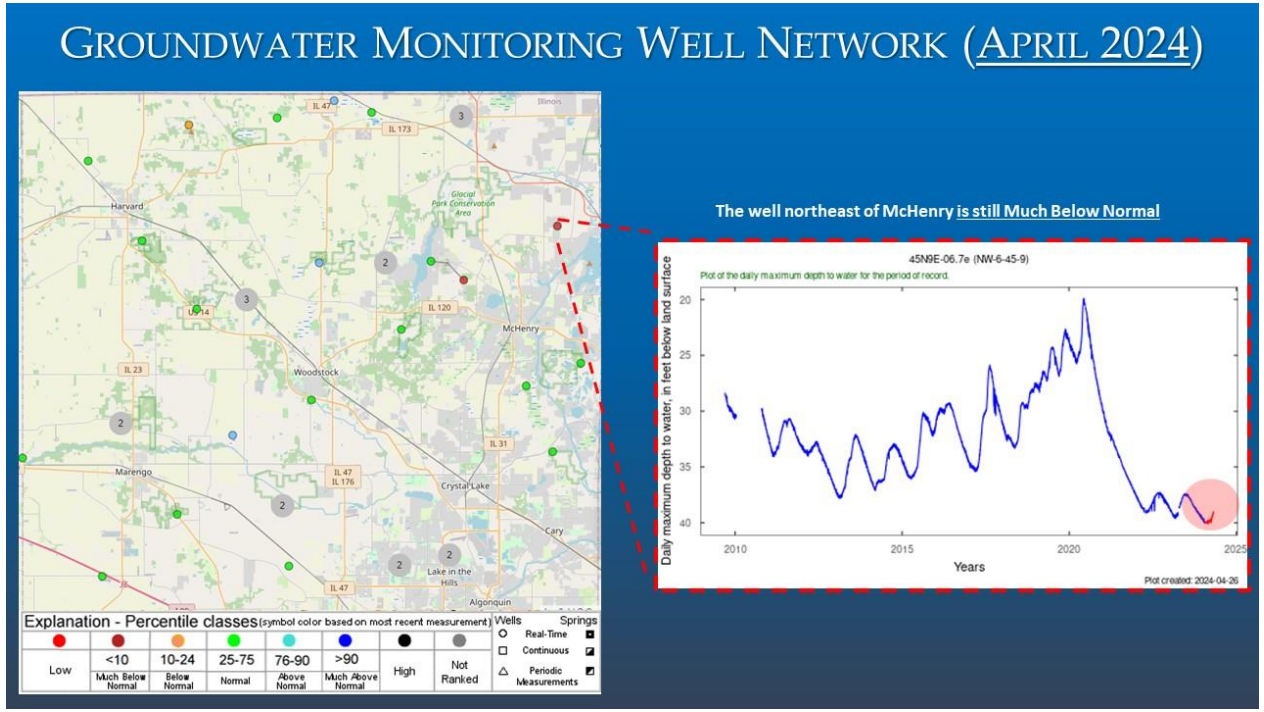


Rapid drawdown of aquifer

Water-level decline of ~6m in 5 years

After only 8 completed of 80-home development

- ***Resident lowered well pump to maintain resource***
- ***Demonstrated need for improved groundwater planning***



Quote from Stakeholder (water-resource manager):

"I can't do my job without it."

Case Study 2: Engineering/Environmental Consulting Firm

Chicago Metropolitan Area

Use by stakeholder (engineering firm):

Geotechnical clients
Proposals
Contract reports
Background research

Quotes from stakeholder:

"Tools that nobody had 20 years ago!"

"Great for a first look!"

"Worth more than 1000 words!"

"Much prefer the viewer over static maps!"

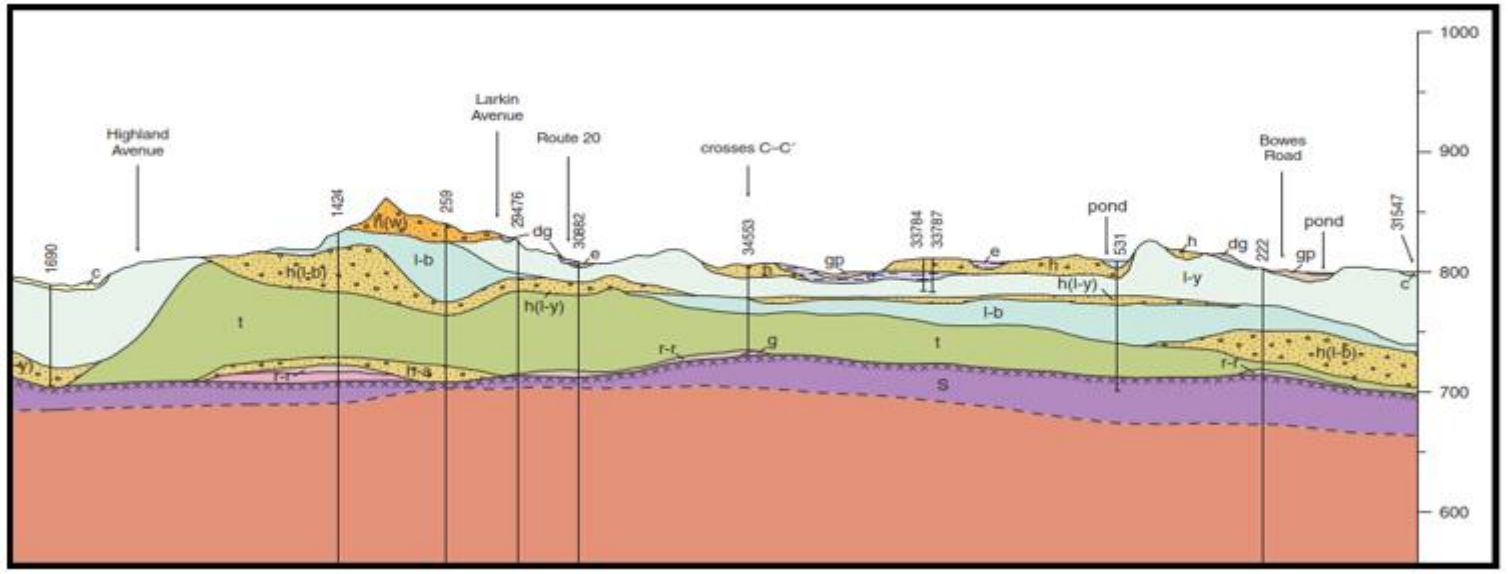
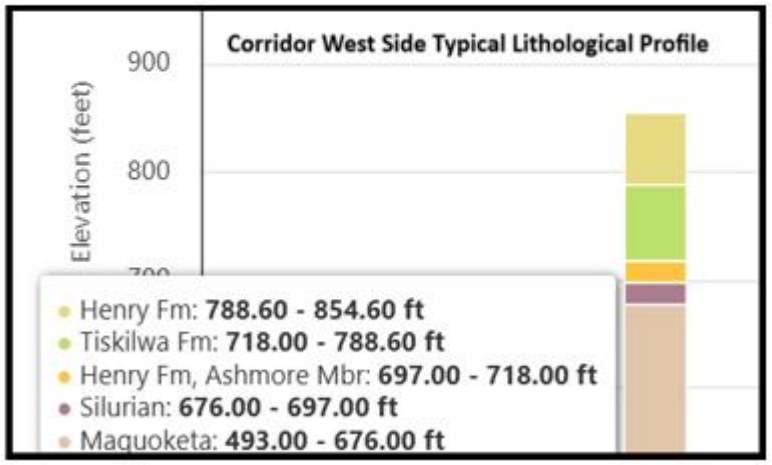
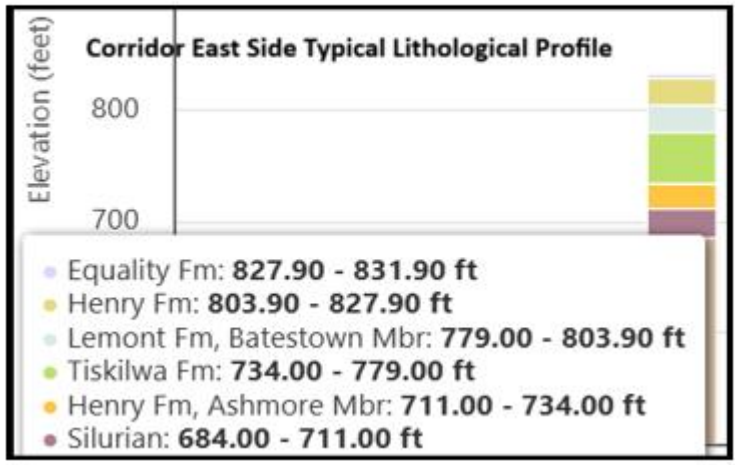


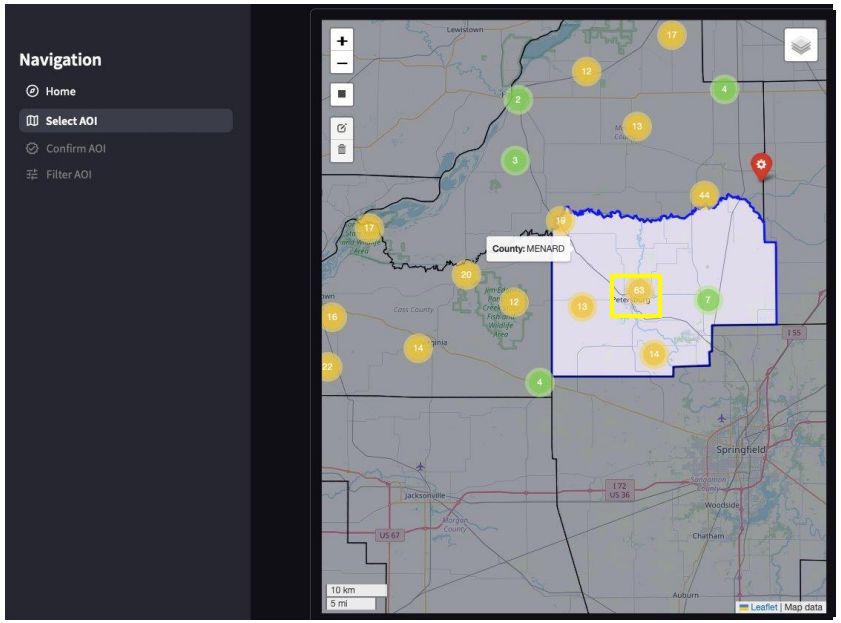
Figure 8: Corridor East Side North-South Soil Profile

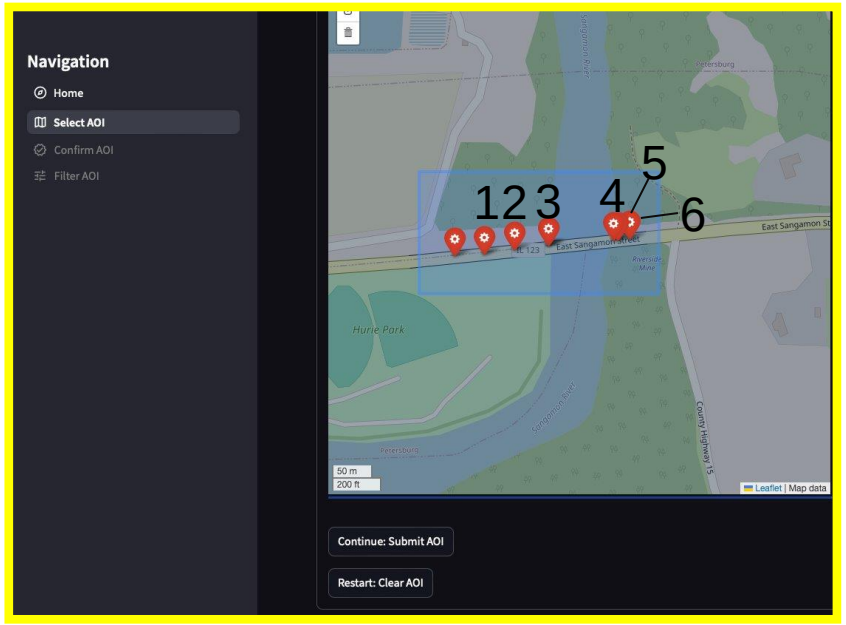


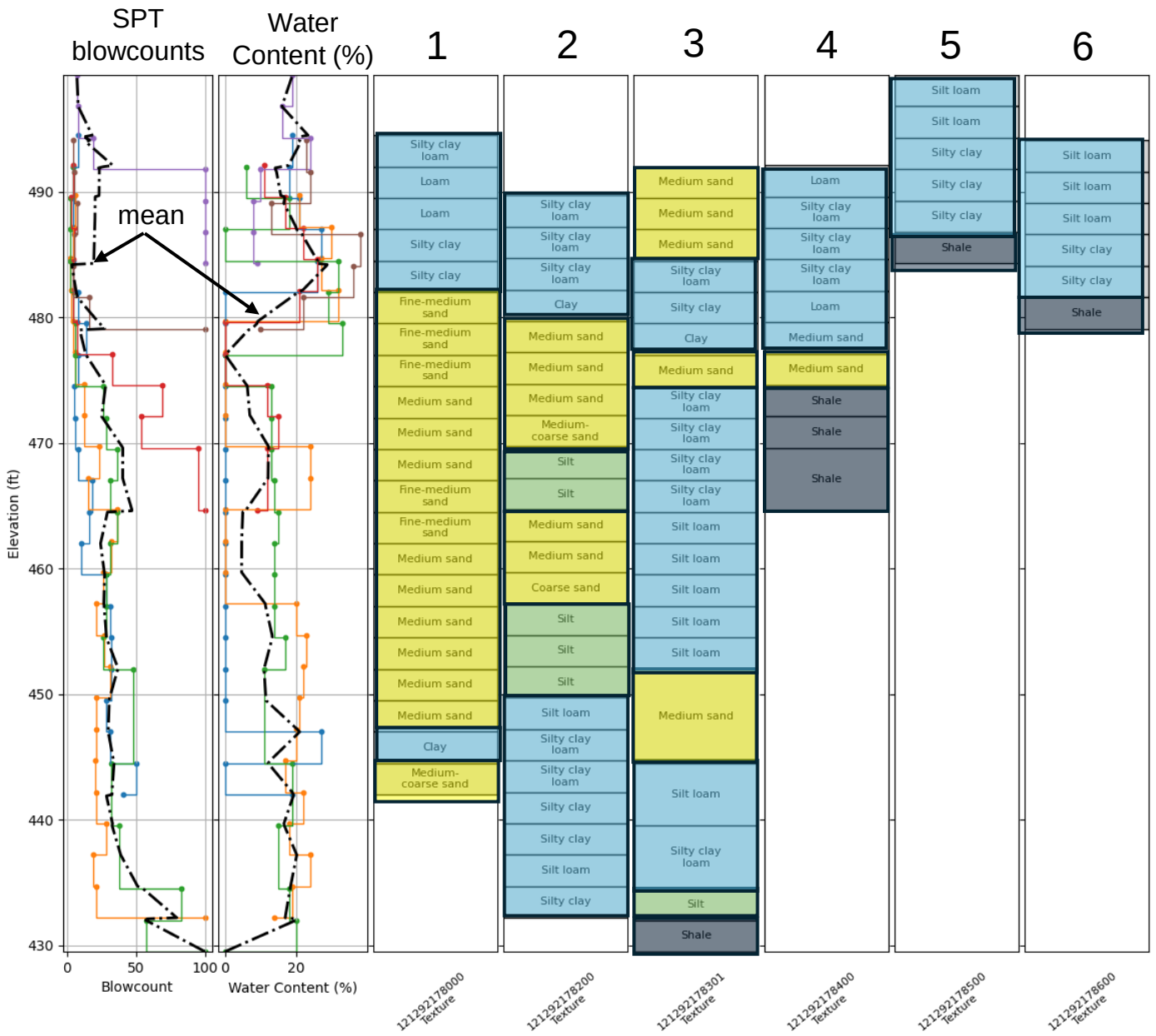


Case Study 3: State Government Transportation Agency

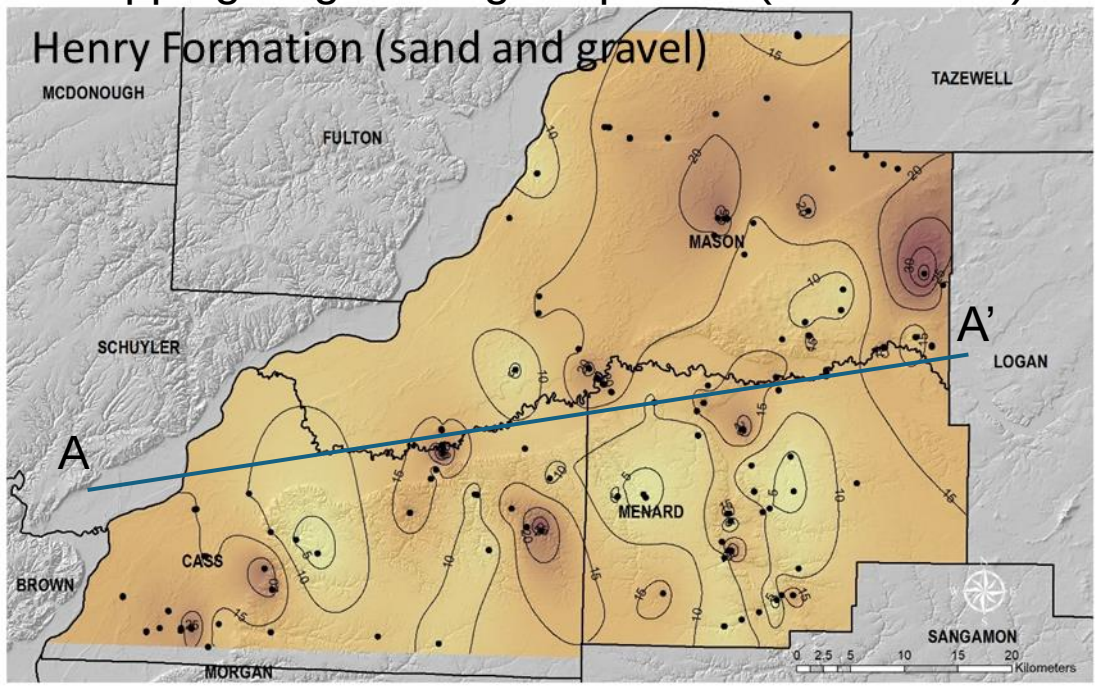
Tools for geotechnical data queries and summaries







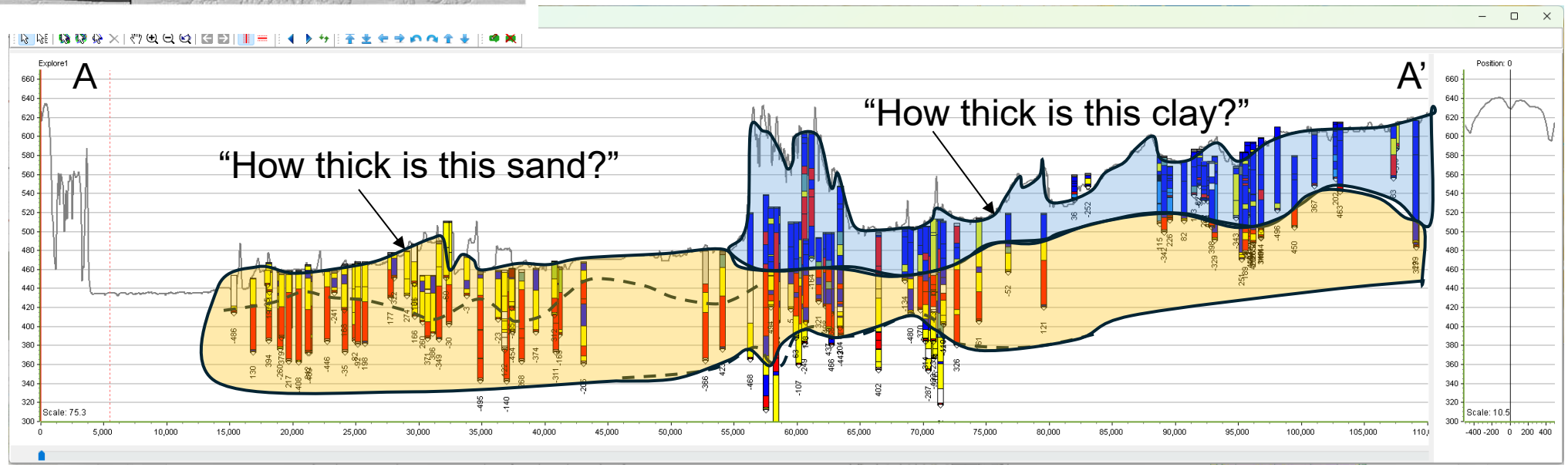
Mapping Engineering Properties (blowcounts)



Case Study 3: State Government Transportation Agency
Tools for geotechnical data queries and summaries

Question to geotech engineer stakeholder:
"What is one thing we could provide that would change your job?'

Answer: "3D geology"



More quotes from stakeholders:

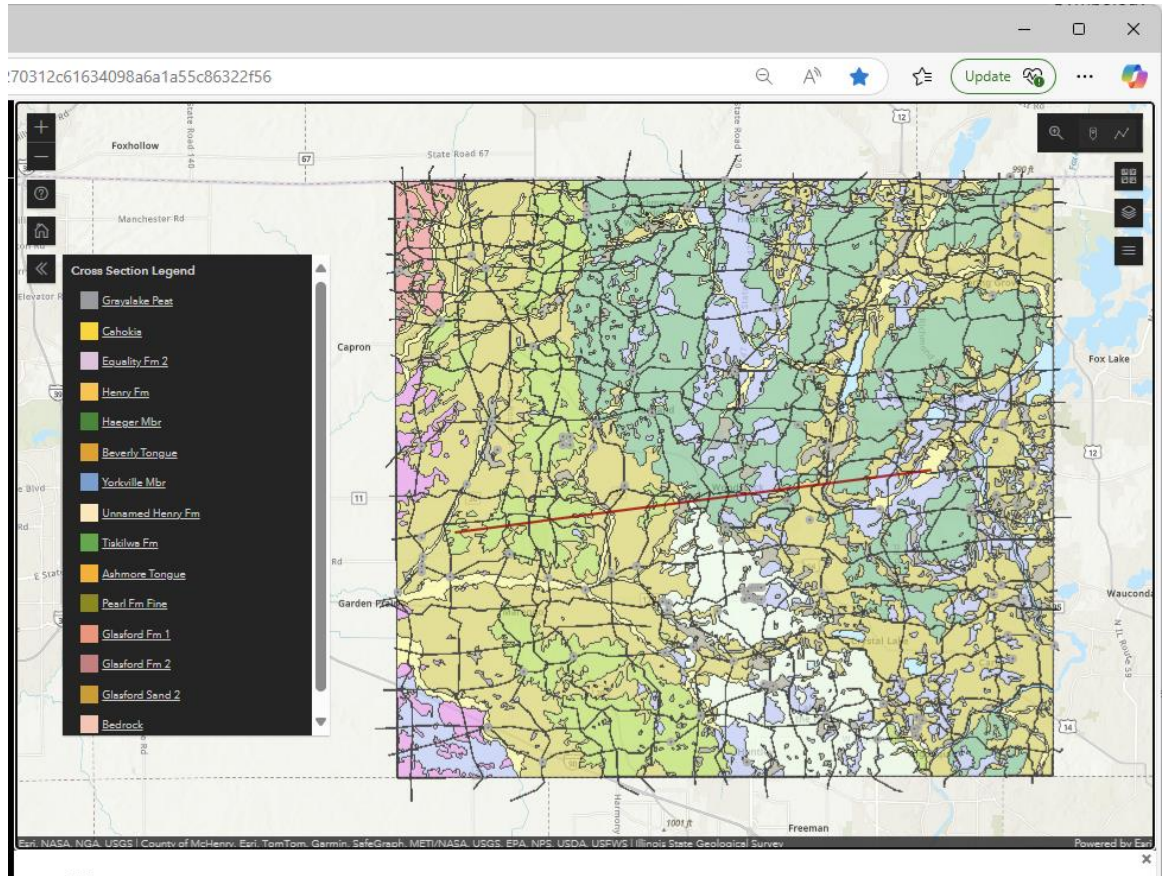
When viewer isn't functioning due to software updates, network updates, etc:

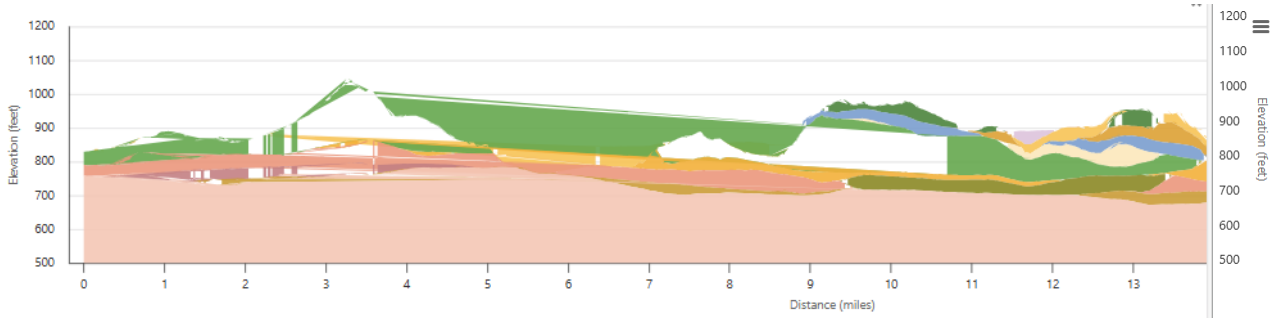
> "Beyond frustrated!"

When rendering quality of cross sections is poor due to v.3x to v.4x update:

> "…makes the system look cheap, unprofessional, and unreliable"

> "…problematic when showing to stakeholders for the first time"





New direction…?

Geo3D

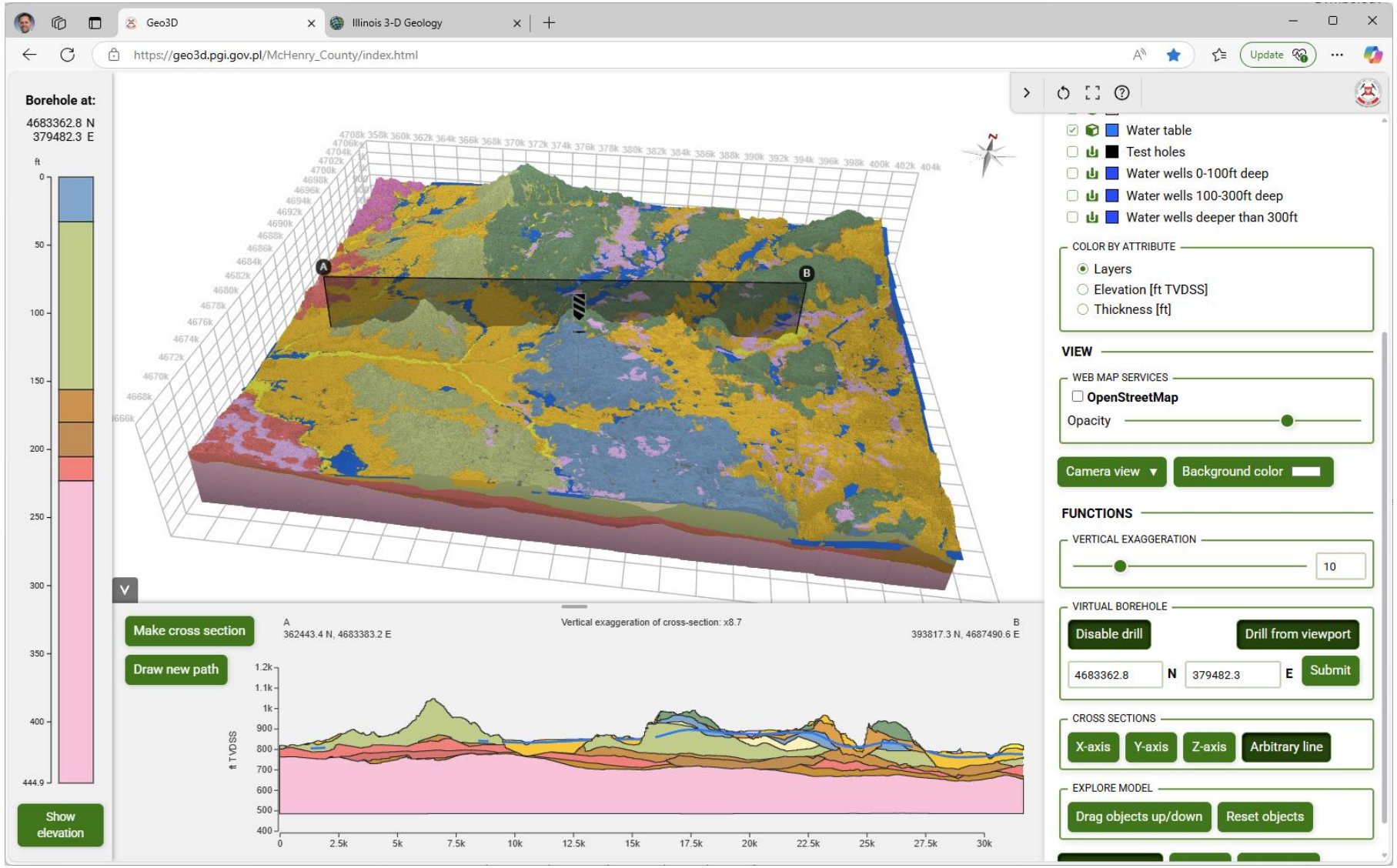
geo3d.pgi.gov.pl (Zbigniew Malolepszy)

Pros

- Robust functionality
- High-quality rendering
- Versatile tools
  - Virtual Drill
  - Cross Sections (axes)
- 3D viewing environment

Cons

- Generally slow with complicated models
- Firewall limitations for our most engaged stakeholder

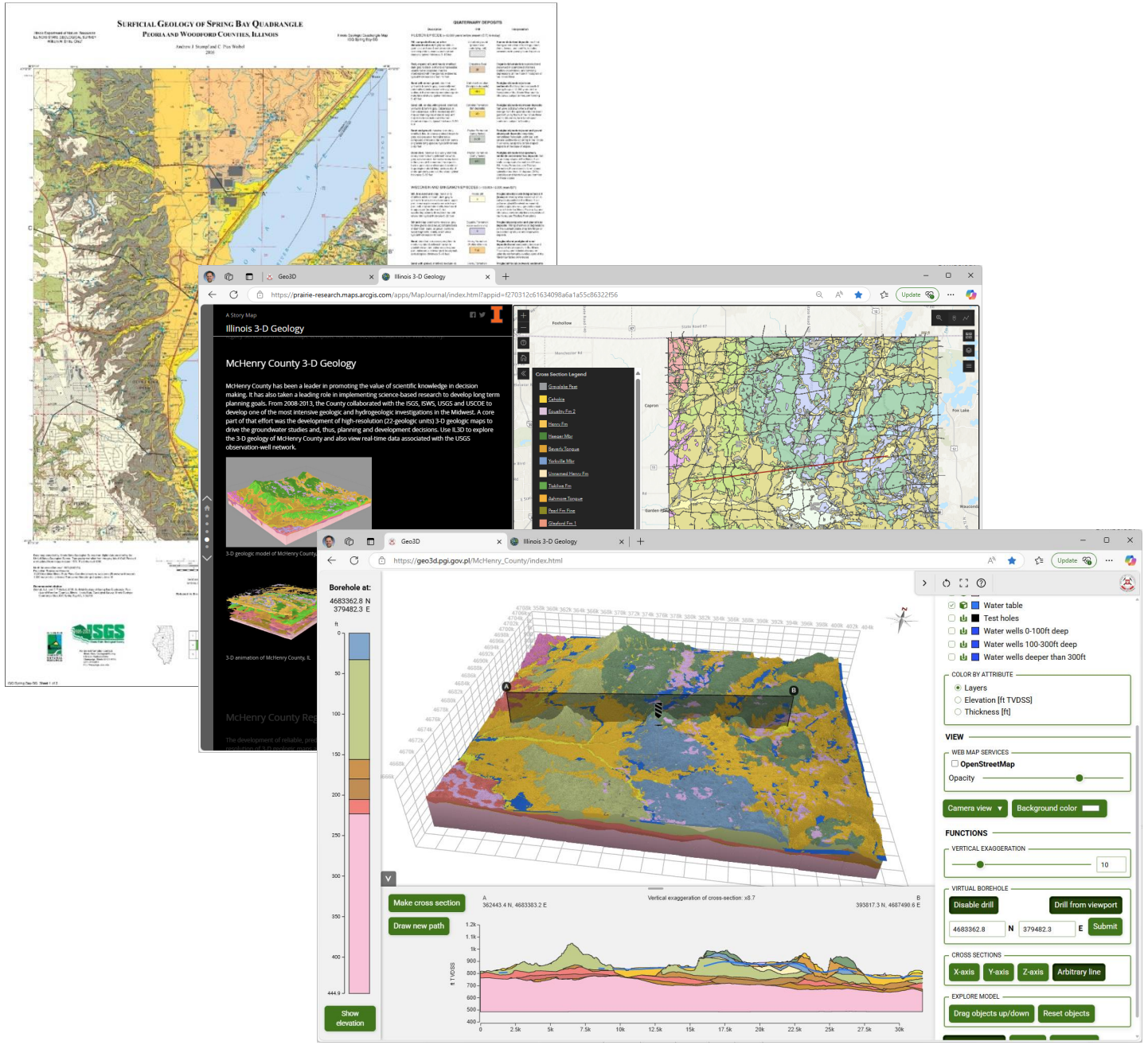


Wrap Up

Meeting Stakeholders Needs

- 3D Viewer Specs:
  - Robust functionality
  - High-quality rendering
  - Versatile tools
    - Virtual Drill
    - Cross Sections (axes)
  - 3D environment
- Our Program Goals
  - Build broader stakeholder buy-in
  - Promote web viewer value
  - 3D program development
    - Rebuild staff resources
    - Software
    - Modelling efficiency
    - Data Ingestion/Export
  - Build stakeholder community

Geo3D!



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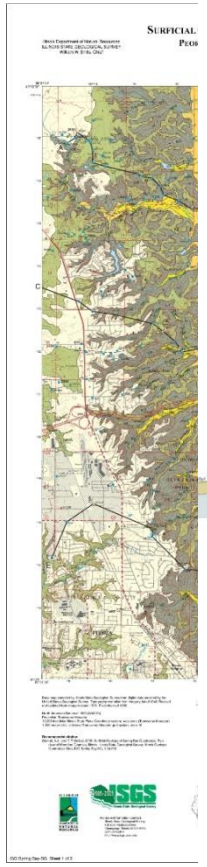

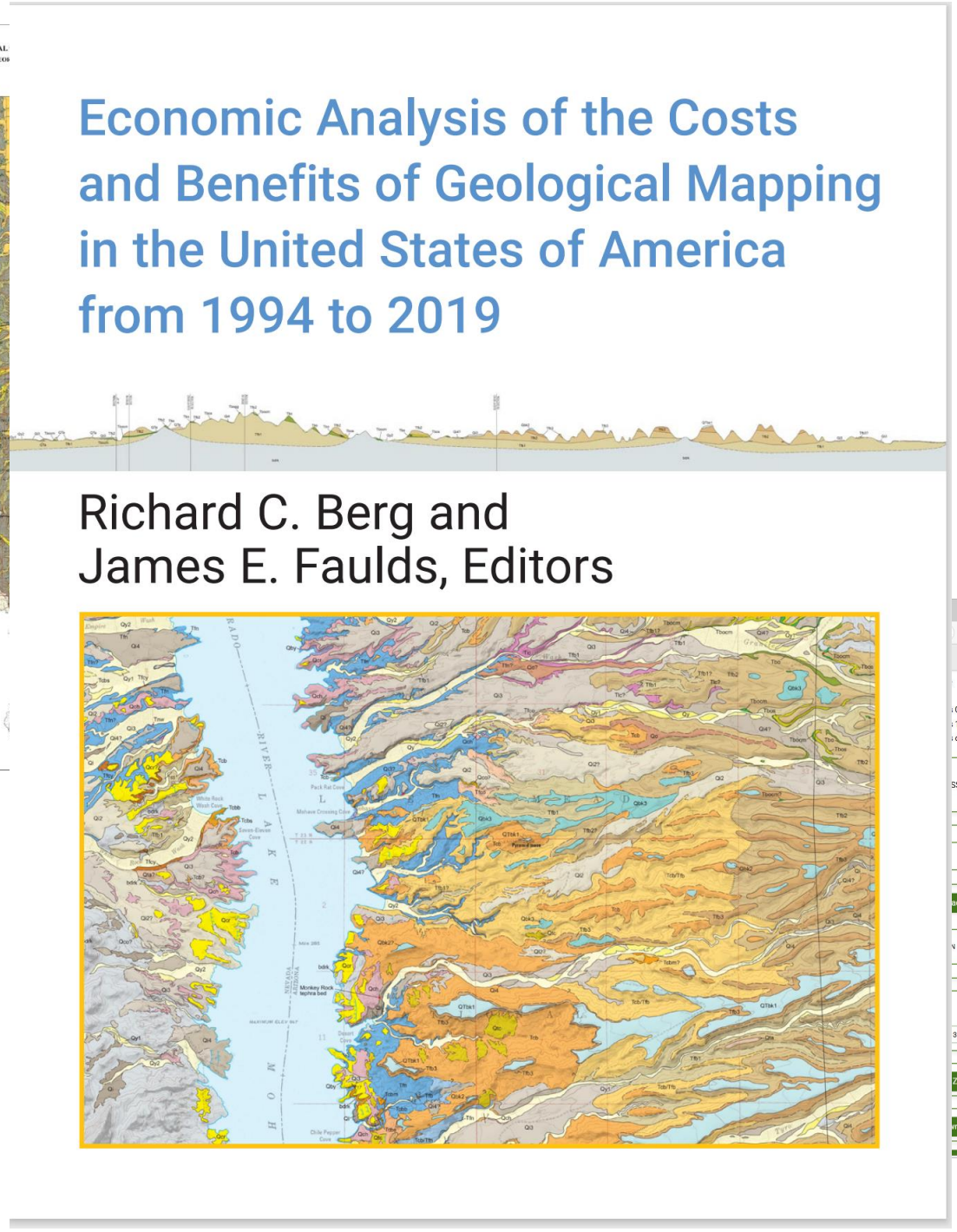

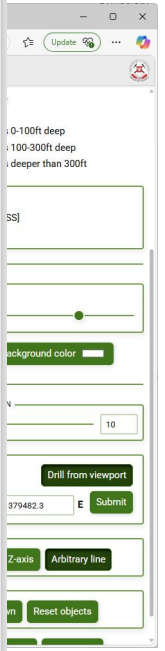

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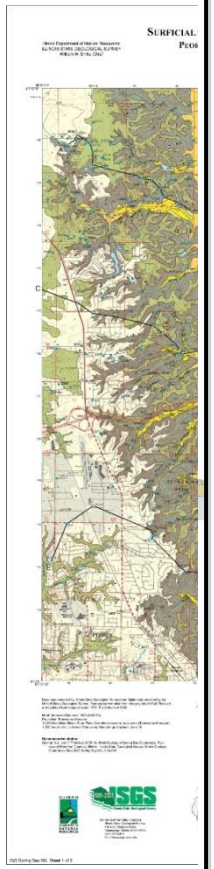
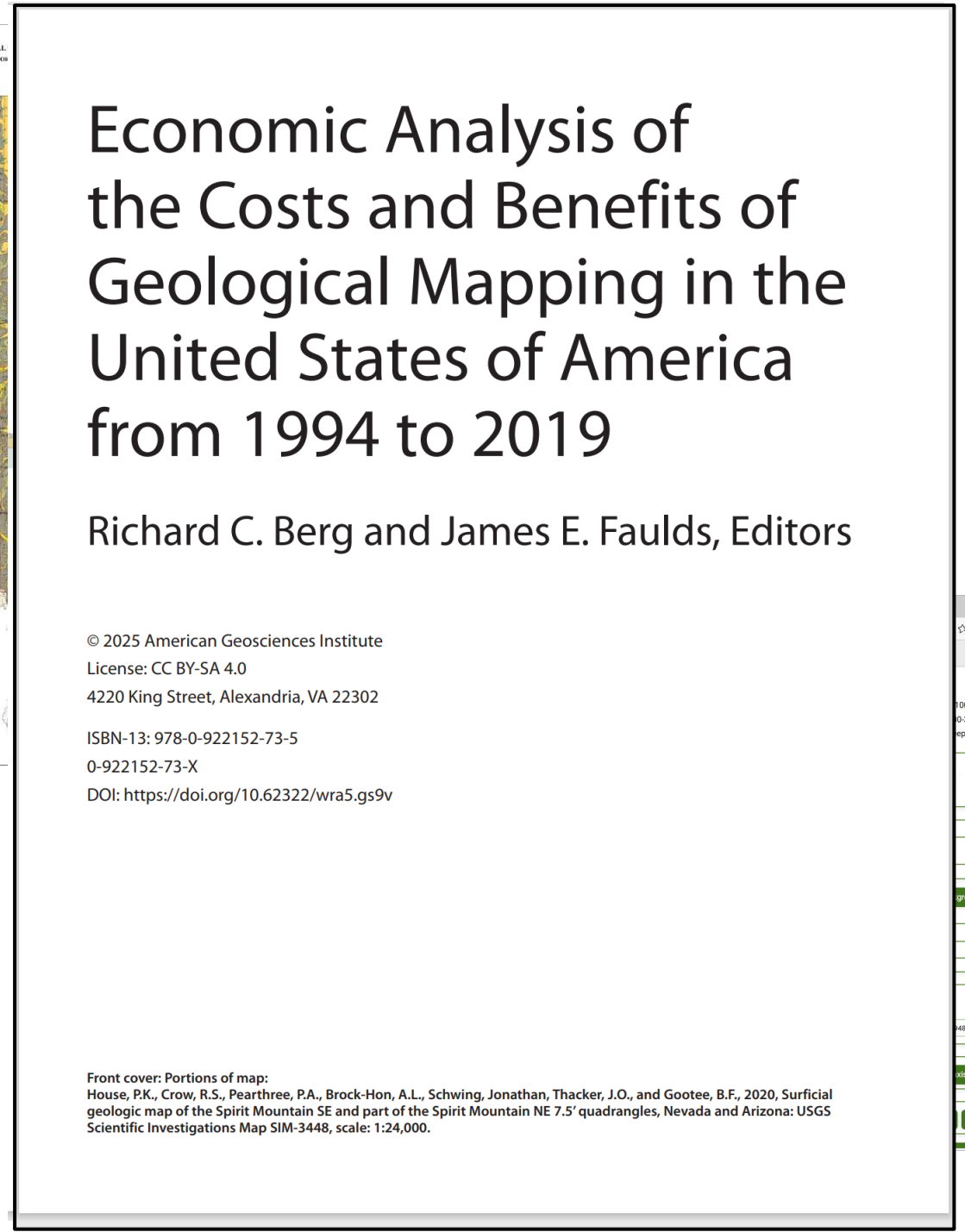
GeoSD!





Economic Analysis of the Costs and Benefits of Geological Mapping in the United States of America from 1994 to 2019

Richard C. Berg and James E. Faulds, Editors

4220 King Street, Alexandria, VA 22302

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0-922152-73-X
DOI: https://doi.org/10.62322/wra5.gs9v

Front cover: Portions of map:
House, P.K., Crow, R.S., Pearthree, P.A., Brock-Hon, A.L., Schwing, Jonathan, Thacker, J.O., and Gootee, B.F., 2020, Surficial geologic map of the Spirit Mountain SE and part of the Spirit Mountain NE 7.5′ quadrangles, Nevada and Arizona: USGS Scientific Investigations Map SIM-3448, scale: 1:24,000.

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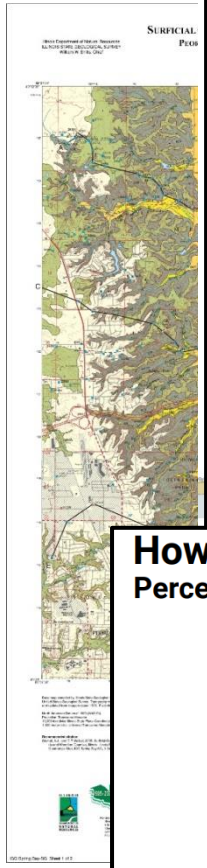

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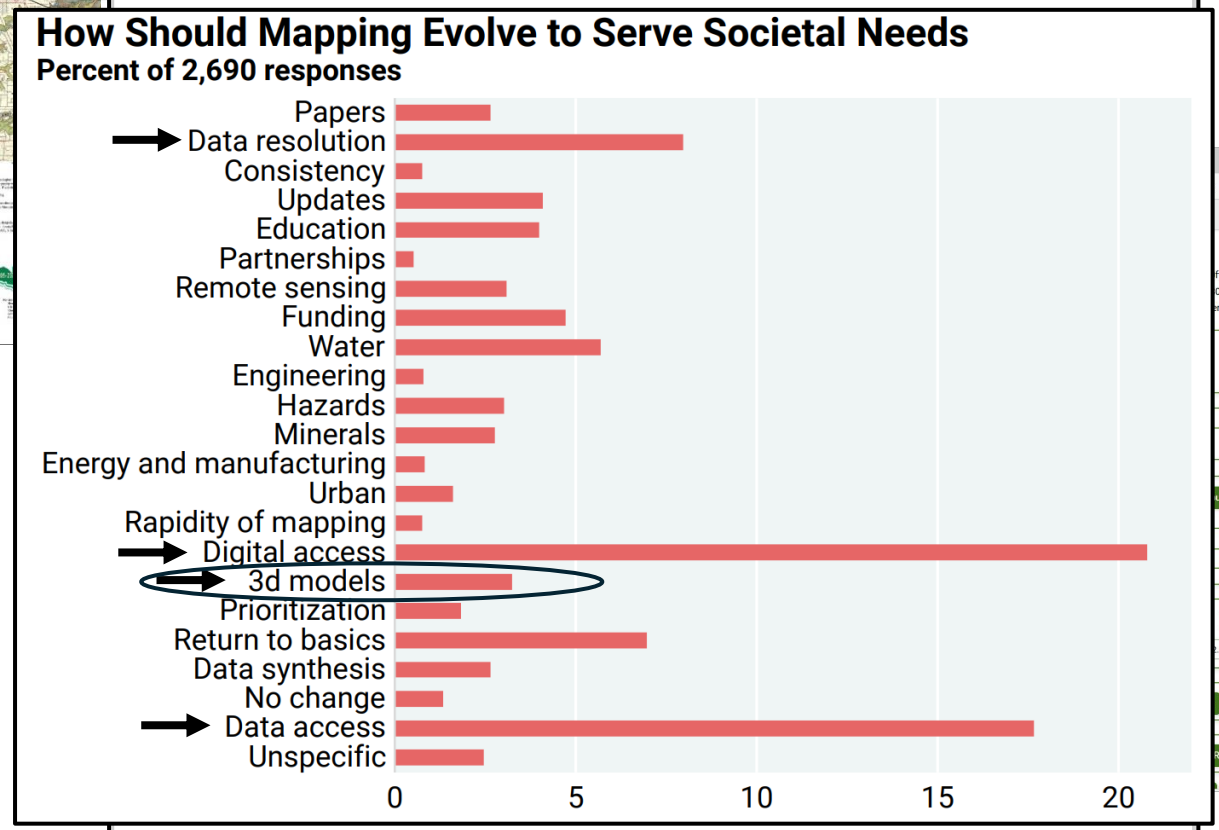

Thank you

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